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PNEUMOTHORAX

IN

TUBERCULOUS SUBJECTS

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PNEUMOTHORAX IN TUBERCULOUS SUBJECTS.¹

PNEUMOTHORAX has been variously estimated as occurring in from $3\frac{1}{2}$ to 10 per cent. of all cases of phthisis. C. T. Williams² even found that it was present in 10 per cent. of necropsies on consumptives. Pneumothorax, in by far the majority of cases, perhaps 80 to 90 per cent. of the total,³ is due to pulmonary tuberculosis. It is possible even that some of the cases of "spontaneous pneumothorax arising in apparently healthy persons" (spontaneous non-tuberculous pneumothorax, as Fussell and Riesman⁴ call it), in which recovery nearly always takes place, may in reality be connected with tuberculosis, in so far as they may be due to the rupture of an adherent emphysematous bulla, resulting from an old local tuberculous lesion. At present I shall only consider pneumothorax occurring in decidedly tuberculous subjects, but in order to give an idea of the average gravity of cases of pneumothorax I will first give a quotation from Dr. J. L. Morse's conclusions in his *Analysis of 51 Cases of Pneumothorax*.⁵ "The cases which recover," says this author, "are practically all serous. They usually die later, however, from pulmonary tuberculosis. The pneumothorax is the direct

¹ Most of this paper was included in a lecture of the Mount Vernon Hospital Post-Graduate Course delivered on June 8th, 1905.

² C. J. B. and C. T. Williams: *Pulmonary Consumption*, second edition, 1887, p. 206.

³ See the remarks on Saussier's much quoted statistics by Dr. S. West, *Diseases of the Organs of Respiration*, 1902, vol. ii., p. 768.

⁴ *American Journal of the Medical Sciences*, August, 1902. These "spontaneous" cases must be distinguished from cases of so-called "idiopathic" pneumothorax, due to gas-producing microbes. See C. P. Emerson's elaborate monograph on Pneumothorax, *Johns Hopkins Hospital Reports*, 1903, vol. xi., p. 364.

⁵ *American Journal of the Medical Sciences*, May, 1900.

cause of death in 60 per cent. 80 per cent. of all cases die in less than a year and only 10 per cent. live over five years."

Doubtless a very large proportion of cases of pneumothorax occurring in tuberculous subjects may be called "terminal," inasmuch as if the pneumothorax is not itself the direct cause of death the tuberculous disease is far advanced and death occurs in the course of a few weeks or months. In regard to prognosis, however, every case must be judged on its own merits, and examples are not rarely met with in which the clinical course is quite different. It is possible, indeed, that in some cases of pneumothorax occurring in tuberculous subjects the onset of the pneumothorax may be due (as in some cases of "spontaneous" pneumothorax in apparently healthy persons), not to an active tuberculous lesion, but to the rupture of an adherent emphysema bulla, connected with a local obsolete tuberculous process, probably in the upper part of the lung; it may, in fact, be due to the results of scarring, though the tuberculous disease may be advancing elsewhere in the lungs and may or may not subsequently lead to the death of the patient after his recovery from the pneumothorax. In some other cases when the pneumothorax commences during a short period of high fever the rupture of the lung may be due to counter-infection with other (non-tuberculous) microbes, producing softening of a subpleural tuberculous nodule.

I shall now give some clinical examples of pneumothorax in tuberculous subjects—it will not be necessary to give examples of the well-known rapidly fatal "terminal" cases—and shall then proceed to the general subject of clinical symptoms and treatment.

CASE 1.—This is an example of pneumothorax supervening in a grave case of pulmonary tuberculosis with high fever, the pneumothorax becoming converted first into a hydro-pneumothorax and then into a chronic hydrothorax, death supervening in about a year. The patient, a young unmarried woman, aged 25 years, was admitted under my care into Mount Vernon Hospital on Feb. 29th, 1904, with a history pointing to pulmonary tuberculosis of one and a half years' duration. There had been slight hæmoptysis two weeks before admission. Her mother had died from consumption. After admission there was at first much fever. On the morning of March 1st the temperature reached 105° F., with a pulse of 124, and respirations of 40 per minute. On the right side of the chest there was deficient

movement; the resonance was impaired all over and there was considerable crepitation over the upper part in front and down to the base behind. There was likewise impairment of resonance over the upper part of the left lung. Tubercle bacilli were found present in the scanty expectoration. Examination of the abdomen and urine showed nothing abnormal. On the evening of March 6th the patient felt a sudden pain in the right hinder part of the thorax which apparently indicated the commencement of the pneumothorax. The pain followed immediately after a fit of coughing. On examination the respirations were found to be 80 per minute and shallow and the pulse was weak and 160 per minute. The right side of the chest was hyper-resonant nearly all over and there was amphoric breathing to be heard at the lower part and a very distinct bell-sound ("bruit d'airain") was obtained in the axillary region. The heart was displaced to the left and the liver dulness was apparently diminished. A hypodermic injection of morphine sulphate (grain $\frac{1}{4}$) with atropine sulphate (grain $\frac{1}{120}$) was given and the patient obtained sleep during the night. On the morning of March 7th she felt better and the pulse was 150 and the respirations were 60 per minute. A succussion splash on March 16th indicated the commencement of fluid effusion into the pneumothorax. On the morning of the 16th the pulse was 104 and the respirations were 28. The temperature at that time oscillated between about 100° and 101° F. but after the 21st it generally remained below 100°. On the 29th the cardiac apex beat was felt in the fifth intercostal space in the left nipple line, so that the heart was nearly in its normal position. On the right side of the chest the breath sounds were diminished and slightly amphoric in character; there was an imperfect bell sound and the cough sound was amphoric in character; a succussion splash could just be obtained but there was no marked dulness to percussion—at all events, with the patient in the sitting position. There were doubtless still a layer of air between the right lung and the chest wall and slight pleural effusion. Afterwards there was increase of the pleural effusion and on April 9th examination by the Roentgen rays showed a dark shadow due to the fluid in the right pleura reaching up to the level of the ninth rib in the scapular line behind. No succussion splash was obtained after May 17th, and the hydropneumothorax had doubtless by that time become converted into a hydrothorax. When the patient left the hospital on June 20th she still had all the signs of a

right pleural effusion reaching up to the scapula behind. By the exploratory syringe (June 13th) the effusion was shown to be serous but slightly turbid. During the last two weeks in the hospital she was up about five hours daily and was allowed to walk about the corridor. She had gained weight since April, but her temperature was often somewhat raised in the evenings and the pulse varied from 84 to 100 per minute. I heard that she died in the latter part of January, 1905.

CASE 2.—This is an example of pneumothorax arising during an acute feverish attack in a tuberculous subject without obvious local signs of tuberculosis and leading to pyopneumothorax which had to be treated by operation, the patient subsequently progressing favourably, though the thoracic fistula would not close. A married woman, aged 28 years, was admitted to the German Hospital under my care on Nov. 14th, 1902.⁶ She had generally enjoyed good health and had given birth to her second child five months previously. Both her children were living and healthy. She had suckled the baby four months but felt weak. She only began to feel really ill, however, a week or two before admission (cough, pains in the back and chest, loss of flesh, &c.). In the hospital she was restless and feverish and in the left lower axillary region there was what seemed to be slight "pleuritic crepitation," not a distinct friction sound. The onset of the pneumothorax was somewhat insidious but it probably commenced on the night of Nov. 22nd to 23rd, perhaps during sleep. Anyhow the signs of pneumothorax on the left side were very well marked when I examined the patient on the morning of Nov. 24th, though the left side of the chest seemed at that time to move with respiration almost as well as the right. The heart was displaced to the right of the sternum and the ordinary cardiac area was hyper-resonant. The expiratory sounds on the left side were amphoric and there was a typical bell sound but no metallic tinkling or succussion splash. The pulse was 128 and the respirations were 44 in the minute (after the examination). The fever continued and about this time moderate albuminuria was noted. The temperature, which during the latter part of November had

⁶ The first part of the clinical history of this case was described by myself in an article on the Clinical Forms of Pneumothorax, *Zeitschrift für Tuberkulose, Leipsic*, 1903, vol. iv., p. 478.

several times risen to 104° , remained below 100° after Dec. 10th and on the 11th the urine was quite free from albumin. The signs of pneumothorax continued and on Dec. 22nd a distinct succussion splash was heard. Considerable fever from Jan. 17th, 1903, indicated the change from a hydropneumothorax to a pyopneumothorax and the patient's general condition and strength rapidly deteriorated. On Jan. 27th the pleura was drained by my surgical colleague, Dr. E. Michels, who resected a piece of the hinder part of the seventh rib. The fever then gradually lessened and after a time the patient's general condition began slowly to improve. In March, 1903, she was allowed to be up and about in the ward. The heart was nearly in its normal position and the lung had evidently re-expanded to a considerable extent.

The patient has now been living in her own home and doing her ordinary household work for a long time. The pulmonary condition remains fairly good, though the fistula in her side still keeps open and discharges slightly, just enough to moisten the dressings. The liver and spleen are not enlarged and there is no albuminuria (April, 1905) or any sign of amyloid disease of the viscera. No adventitious sounds can be heard over the lungs nor can any positive physical signs of pulmonary tuberculosis be made out, though the left side of the thorax shows some contraction and a certain impairment of resonance and breath sounds. The cardiac apex beat is slightly displaced to the left. When the patient was in the hospital the tuberculin test gave a positive result, a typical febrile reaction following the injection of two milligrammes (there was no reaction after one milligramme) of Koch's old tuberculin, but otherwise there have not been really definite signs of tuberculosis.

CASE 3.—This illustrates recovery from pneumothorax, without the occurrence of any pleuritic effusion, in a practically hopeless tuberculous case, the patient subsequently dying from advance of his tuberculous disease. It may be compared to a case recorded by Dr. S. West to which I shall afterwards allude. The patient, a policeman, aged 23 years, was admitted to the Mount Vernon Hospital under the care of Dr. J. E. Squire⁷ on March 31st, 1903.

⁷ I have to thank Dr. Squire, my colleague at the Mount Vernon Hospital, and Dr. P. J. F. Lush, physician to Friedenheim Hospital, for the kind permission to narrate this case and have likewise to thank Dr. S. R. Williams and Mr. A. Coleridge, formerly residents at the Mount Vernon Hospital, for much information regarding it.

He had been ill during the last year but had continued to work up to the time of admission. Dulness, bronchial breathing, and moist crepitation were present over the whole left lung and the upper part of the right lung. His temperature ran up to 102° – 104° F. in the evenings. There was considerable tuberculous ulceration of the larynx. On April 15th the patient complained of sharp pain on the left side after a severe fit of coughing and signs of left-sided pneumothorax developed: loss of movement on the left side, hyper-resonance to percussion, almost complete absence of breath sounds, displacement of the heart to the right, dyspnoea, and frequent pulse (160 beats in the minute). In a few days his general condition began to improve, his pulse fell to under 100 per minute, and his temperature came down to below 100° . The signs of pneumothorax commenced gradually to clear up without any liquid pleuritic effusion being detected. The patient left the hospital in the second half of May, 1903, and obtained admission to Friedenheim. In the first week of July, 1903, no signs of pneumothorax or pleuritic effusion could be detected and the heart was in its normal position. The tuberculous process appeared to have quieted down but there was slight evening fever (100° to 100.5°). Soon afterwards the patient was discharged from Friedenheim but was readmitted in March, 1904, and I was kindly allowed to examine him on April 5th. The cardiac apex beat was felt at about the normal position. There were cavernous signs over the whole lower part of the left lung and there was stridor from laryngeal disease. The patient died in May, 1904, and at the necropsy no remnant of the pneumothorax could be found but the adherent pleura was so thick and dense that the left lung could not be removed. There were two large cavities in the right lung.

ONSET AND SYMPTOMS OF PNEUMOTHORAX IN TUBERCULOUS CASES.

The physical signs will depend largely on whether the pneumothorax is complete (diffuse) or limited by pleuritic adhesions and, if the latter, on the position and extent of the adhesions. Adhesions in the front of the lung may check the displacement of the heart and mediastinum which constitutes one of the most important physical signs, if not

actually the most important sign, in cases of complete pneumothorax. Moreover, in cases of limited pneumothorax the onset is more likely to escape attention (latent pneumothorax), especially in weak patients already confined to bed, and when the pneumothorax is on the side most damaged by the tuberculosis, whereas when complete pneumothorax occurs in relatively vigorous patients and when the lung of the opposite side is already much diseased the onset is generally marked by urgent distress, dyspnoea, sometimes faintness and often severe pain, especially on exertion or movement. The initial distress is likely to increase rapidly and to demand relief by paracentesis, if the opening in the lung is very minute and acts as a valve, admitting air into the pleura during inspiration but not allowing it to escape during expiration (the so-called "valvular pneumothorax"). An important point is that one or more of the best known physical signs of pneumothorax may be absent, at least at the time of examination. Thus amphoric breathing is very often (for a time at least) absent⁸ and frequently no breath sounds at all can be heard (silent pneumothorax); the "bell sound" ("bruit d'airain") cannot always be obtained and (in some cases of early pneumothorax) the respiratory movements of the affected side of the chest may be almost equal to those of the sound side. In some cases metallic tinkling at the commencement of pneumothorax may be loud enough to be heard by the patient himself (Fairfax⁹) or by everyone in the room (Allbutt¹⁰). Amongst the conditions which may be mistaken for limited pneumothorax is subphrenic abscess due to perforation of the stomach or bowel and this condition has even been named "subphrenic pyopneumothorax" (Leyden) or "false pneumothorax." In cases of hydro-pneumothorax and pyopneumothorax Bäumler¹¹ draws attention to the occasional occurrence of tympanitic islands within the dull area of pleuritic effusion. One explanation which he offers is that these resonant patches may be due to

⁸ The presence or absence of amphoric breathing does not entirely depend on whether the pneumothorax is open or closed—that is, whether there is a free opening or not through the lung (Cf. S. West, loc. cit., p. 787).

⁹ Quoted by Emerson (loc. cit.) from the Richmond Medical Journal, February, 1868.

¹⁰ Allbutt's patient was, however, apparently not tuberculous. See footnote in *System of Medicine*, vol. v., p. 383.

¹¹ *Deutsches Archiv für Klinische Medizin*, Leipzig, 1905, vol. lxxxiv., p. 11.

portions of the lung being attached to the chest wall by old pleuritic adhesions.

COURSE AND PROGNOSIS.

In many cases, as I have already mentioned, the pneumothorax must be regarded as the terminal stage of the tuberculous disease. Occasionally patients die almost immediately after the onset. More frequently they survive the period of onset and in a few days the physical signs (succussion splash, &c.) show that liquid as well as air is present in the pleural cavity. The liquid is generally serous at first (hydropneumothorax) and in some cases certainly it never becomes really purulent (pyopneumothorax). Even in bad cases the dyspnœa and distress usually present at the onset of the pneumothorax become much less marked in the course of a day or so. The patient's organism succeeds in accommodating itself to the alteration in its respiratory mechanism, so that a kind of compensation occurs. This accommodation of the organism to the new conditions may be especially marked in cases of relatively favourable prognosis, when the distress at the onset of pneumothorax is very great, perhaps greater than in less favourable cases.

In by far the majority of cases the pneumothorax occurs when the changes in the lungs are already far advanced but it may occur at any stage of pulmonary tuberculosis and may even be the result of a single tuberculous lesion. Thus S. West¹² mentions the case of an elderly man who developed pneumothorax without urgent symptoms (latent pneumothorax) and who died from exhaustion; at the necropsy the pneumothorax was found to be due to the rupture of a small caseous cavity near the root of the right lung and no other disease was discovered in the whole body. Austin Flint¹³ recorded the case of a young accountant, aged 18 years, who had suffered from hydropneumothorax of the left side for a good time before his death (his death was determined by pneumonia of the right lung). At the necropsy a little cavity was found in the left lung which had probably led to the pneumothorax, for there were no other cavities or tuberculous

¹² Loc. cit., p. 807.

¹³ In an article on Pneumothorax in *American Clinical Lectures*, 1876, vol. i., p. 77. See also Andral's opinion on this subject, quoted by M. Naumann, *Deutsche Klinik*, 1854, p. 293.

masses. Letulle gives a case in which the lung contained only one tuberculous nodule, the rupture of which gave rise to the pneumothorax.¹¹

In a few tuberculous cases the pneumothorax has disappeared without any liquid being effused into the pleura.¹⁵ Surely, however, in some at least of these cases the pneumothorax was not due to any actual tuberculous lesion but rather to emphysematous changes associated with some localised chronic or obsolete pulmonary tuberculosis, for instance, to the tearing of a superficial bulla, perhaps connected by an adhesion with the opposite pleural surface. Thus Dr. H. B. Whitney¹⁶ records a case of pneumothorax occurring suddenly in a man (aged 70 years!) who is supposed to have suffered formerly from pulmonary tuberculosis. On account of severe pressure symptoms the pneumothorax was tapped and a cannula was left in the chest for several days. Complete recovery followed. A superficial emphysematous change or a pleuritic adhesion, associated with chronic or obsolete tuberculous lesions, affords the most reasonable explanation of the occurrence of pneumothorax in such a case. In support of this view Dittrich's case may be adduced.¹⁷ It is that of a medical man, aged 28 years, who had quiescent pulmonary tuberculosis and also emphysema. Whilst walking he was suddenly seized with fatal left-sided pneumothorax, which the post-mortem examination showed to be caused by rupture of a subpleural bulla situated in a portion of the lung (the apex) showing cicatricial changes. Emphysema may, indeed, in certain cases be regarded as a connecting link between tuberculous lesions and pneumothorax, as was pointed out long ago by A. Brännicke of Copenhagen.¹⁸ It is to be remarked that in certain cases in which pneumothorax has appeared to be due to the rupture of an emphysema bulla the emphysematous change has been found, not in the lower part of the lung, its favourite site in ordinary cases of emphysema, but in the upper part, at or near the apex, in which position

¹⁴ Cf. Russell, Case of Pneumothorax occurring at the Very Commencement of Tubercular Deposit of the Lung, *Brit. Med. Jour.*, March 24th, 1866.

¹⁵ Vide S. West, *loc. cit.*, p. 800, Case 3. See also the examples collected by L. Galliard, *Le Pneumothorax*, 1892, p. 169.

¹⁶ *Philadelphia Medical Journal*, Jan. 14th, 1899, p. 93, Case 2.

¹⁷ Dittrich's well-known case was first published by Dr. M. A. Wintrich in his *Krankheiten der Respirationsorgane*, Erlangen, 1854, p. 352.

¹⁸ English translation in *Dublin Hospital Gazette*, 1856, vol. iii., p. 111.

it is often associated with obsolete tuberculous lesions or cicatrices from other causes. Thus, in a case of fatal hæmo-pneumothorax described by G. Newton Pitt¹⁹ the cause was apparently the rupture of an emphysema bulla near the apex of the right lung but the bulla was adherent to the chest wall, and it seems to me that the existence of both the adhesion and the bulla in this case may very well have been due to a former minute tuberculous lesion.

Examples of pneumothorax due to the tearing of a superficial (subpleural) bulla fastened by an adhesion to the opposite pleural surface are to be found in F. W. Zahn's paper, *Ueber die Entstehungsweise von Pneumothorax*.²⁰ In this connexion W. H. Ranking's²¹ case may likewise be referred to, though it has often been quoted in support of a different view. It is that of a young man, aged 19 years, who, while at church, was suddenly seized with the symptoms of left-sided pneumothorax. The pneumothorax was gradually recovered from within two months, but later the patient died suddenly from the effects of a dissecting aneurysm of the aorta. At the necropsy the lungs were found free from tubercles but there were some dilated air cells, especially near the apex of the left lung. Here, again, it must be remembered that emphysema bullæ near the apex of the lung, especially in young persons, are often connected with older cicatricial tuberculous processes.

In hydropneumothorax in tuberculous subjects cure has been known occasionally to occur with or without operative interference.²² I have recently heard of an instance of such recovery in the case of a medical man who developed pneumothorax some years ago. More than 50 years ago Professor J. T. Banks of Dublin narrated the case of a man, aged 30 years, who was admitted into the Whitworth Hospital in August, 1851, with signs of left-sided hydro-pneumothorax, evidently associated with pulmonary tuberculosis. No paracentesis or operation of any kind was performed. He left the hospital in June, 1852, but long before this the signs of air and fluid in the left pleura had ceased to exist. He was able to return to his ordinary work, the tuberculous disease becoming apparently arrested. He was seen again by Professor Banks in 1854.²³ It must be remem-

¹⁹ Transactions of the Clinical Society of London, vol. xxxiii., p. 95.

²⁰ Virchow's Archiv, 1891, vol. cxxiii., p. 197.

²¹ Ranking: Brit. Med. Jour., 1860, p. 665.

²² Cf. L. Galliard, *Le Pneumothorax*, p. 171.

²³ Dublin Quarterly Journal of Medical Science, 1854, vol. xvii., p. 318.

bered, however, that recovery from the pneumothorax may take place even though the patient dies soon afterwards from progress of the tuberculous disease. Thus S. West²⁴ records the case of a phthisical girl, aged 19 years, who developed pneumothorax of the left side and recovered from this complication in five weeks without any liquid effusion into the pleura having been detected. She died, however, a few months later from progress of the tuberculous disease. T. Bushby²⁵ attended a phthisical gentleman, about 44 years of age, who slowly recovered from an attack of right-sided pneumothorax without liquid effusion but who a few months afterwards showed decided signs of increase of the pulmonary tuberculosis. With these cases the third case I narrated above may be compared. Similarly Rose²⁶ records the case of a man, aged 24 years, who died from tuberculous meningitis shortly after recovering from tuberculous hydro-pneumothorax of the right side. The necropsy showed universal pleural adhesion of that side.

The prognosis as to the patient's ultimate prospects of life and partial or complete recovery of strength must depend on the extent of the tuberculous disease in his lungs, on his general condition, and, of course, on the local and general treatment adopted. To the subject of treatment I shall return later. Older writers have recorded cases of phthisical persons living a few years and able to enjoy life after the onset of pneumothorax. Thus, Dr. G. H. Burrow²⁷ gave the case of a consumptive woman, aged 21 years, who lived at least three years after the onset of pneumothorax. Dr. H. M. Hughes²⁸ narrated the case of a phthisical woman, aged 26 years, who developed hydro-pneumothorax on the right side and lived two and a half years. He also mentioned²⁹ the case of a young man who lived over three years after the occurrence of pneumothorax and who, during a great portion of that time, was in the habit of riding up from Lewisham to transact his business in London and by agitating his body he used to produce a succussion sound for the amusement of his friends. There is no definite evidence, however, of the last case being

²⁴ Loc. cit., p. 800.

²⁵ *Liverpool Medico-Chirurgical Journal*, 1898, vol. xviii., p. 198.

²⁶ *Deutsche Medicinische Wochenschrift*, 1899, vol. xxv., p. 708.

²⁷ *Guy's Hospital Reports*, 1839, vol. iv., p. 339.

²⁸ *Guy's Hospital Reports*, 1853, vol. viii., p. 20. After death the right pleura was found to contain sero-purulent liquid but no air.

²⁹ Loc. cit., p. 3. No post-mortem examination is recorded in this case.

one of pulmonary tuberculosis, though it probably was. J. T. Banks in 1854 described a case, already alluded to, of recovery from tuberculous hydropneumothorax without paracentesis thoracis or any surgical interference. Further on I shall refer to results obtained in more modern cases, mostly with the help of paracentesis or operation.

TREATMENT.

The treatment of pneumothorax occurring in tuberculous subjects is that of pneumothorax generally, together with the hygienic measures peculiarly suitable for the pulmonary tuberculosis (open-air, feeding, climate), especially in regard to after-treatment. The question of treatment may be considered under measures to be adopted at the commencement of the pneumothorax and those which may become advisable later. If the onset be accompanied by symptoms of collapse, diffusible stimulants will be required. Sometimes special cardiac stimulants, such as digitalis or strophanthus, are given. In some cases sedatives, such as codeine or a small hypodermic injection of morphine, are indicated to relieve pain and excitement, but great caution must be exercised in regard to the dose as a decided narcotic effect may easily be harmful. Aperients may be serviceable to diminish the congestion of the portal system when pneumothorax occurs in relatively full-blooded individuals. The patient should not be unnecessarily moved about as movements increase the dyspnoea and distress. Inhalation of oxygen may, perhaps, be of temporary use. Whenever there is reason to believe that the distress is due to excessive tension of the pneumothorax ("valvular pneumothorax") the air may be allowed to escape by (West's method) a cannula with an indiarubber tube attached, the other end of the tube being allowed to hang down into a basin of sterilised water, or the air may be allowed to escape through a cannula into antiseptic dressings.³⁰ The necessity for paracentesis probably arises only in a very limited number of cases³¹ and

³⁰ With proper care, however, an ordinary aspirator can certainly be used, as Dr. G. A. Sutherland (*THE LANCET*, June 25th, 1892, p. 1419) and others have shown.

³¹ Cf. remarks of Dr. Squire at the discussion on the Treatment of Tuberculous Pleural Effusion and Pneumothorax at the annual meeting of the British Medical Association, 1904, *Brit. Med. Jour.*, Oct. 15th, 1904.

in most of them not very long after the onset of the pneumothorax.

Here I may shortly allude to quite modern trials in regard to the treatment of pneumothorax. Dr. H. von Schrötter³² relates the case of a boy, aged 17 years, who having previously enjoyed good health began to suffer from fever and sweating. On April 10th whilst sitting still he felt sudden pain in the chest, became dyspnoeic, and was obliged to go to bed. On April 15th after admission to the hospital he was found to have a closed pneumothorax on the right side, without any fluid effusion. The right lung was certainly quite collapsed. The treatment adopted consisted in the aspiration of air from the pleura and the introduction of oxygen into the lung by a metal catheter inserted into the right bronchus. At the first sitting about 2200 cubic centimetres of air were removed from the right pleura and at the second sitting 500 cubic centimetres more. The effect of this treatment was watched and controlled by Roentgen ray examination. The last remains of the pneumothorax were made to disappear by the help of long-continued inspiration of oxygen under increased pressure, using an inhalation mask for the purpose. The tuberculin test proved the existence in the patient of localised tuberculosis. Though the result was good it is certainly possible in the light of other cases to suppose that the pneumothorax might have been rapidly recovered from, even without the special means adopted to re-expand the lung. In connexion with this case it should be mentioned that L. Brauer³³ has devised an ingenious apparatus for increasing the pressure of the air in the lungs during operations in which the pleural cavity has to be opened. He has likewise suggested its possible use as a method of treatment for pneumothorax in tuberculous subjects.

In some cases, as already stated, recovery from the pneumothorax (without operative treatment) may take place without any fluid being poured out into the pleura, but in most cases the occurrence of a succussion splash soon shows the presence of a serous, sero-purulent, or purulent³⁴ effusion,

³² Wiener Medicinische Wochenschrift, 1904, No. 26, p. 1228.

³³ Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie, Jena, 1904, vol. xiii.

³⁴ In chronic tuberculous empyema and pyopneumothorax the effusion may contain a great quantity of granular debris ("empyème graisseux").

in fact, that the case has become one of hydropneumothorax or pyopneumothorax. The further treatment of cases of tuberculous hydropneumothorax and pyopneumothorax must to some extent depend on the general condition of the patient. In the "terminal" cases and when pulmonary tuberculosis is extremely advanced, a regular surgical operation can scarcely be recommended, but the fluid may be removed by paracentesis. In cases of pyopneumothorax without extensive pulmonary tuberculosis an operation like that for ordinary empyema is likely to give the most satisfactory results, though repeated paracentesis has often been practised, occasionally, as I shall point out later, with excellent results. Hydropneumothorax, as already stated, does not always turn into pyopneumothorax, and has sometimes, like pneumothorax without liquid effusion, healed spontaneously. It is usually treated by paracentesis,³⁵ but if the tuberculosis be not too advanced and repeated paracentesis fails an operation like that for empyema and pyopneumothorax may possibly, as S. West points out, be undertaken and lead to cure. It may be likewise incidentally noted that in one case at least a dry pneumothorax in a tuberculous subject has been treated by incision.³⁶

In considering the results in individual cases obtained by operation it must not be forgotten that phthisical patients with pyopneumothorax (or at all events with a turbid serous or sero-purulent effusion) have been known to live a considerable time and even to have recovered, though operative treatment was limited to paracentesis.³⁷ In this connexion I would refer to cases recorded by L. Spengler and F. Penzoldt, but I shall have to consider them later in regard to the general treatment adopted. S. West gives relatively good results in a tuberculous hydropneumothorax by paracentesis³⁸ and in a case with sero-purulent effusion by incision.³⁹ L. Galliard⁴⁰ quotes illustrative cases of

³⁵ If a pneumothorax of any kind be aspirated, great care must be taken to aspirate very gently so as not to reopen the perforation in the lung which may have become closed.

³⁶ This treatment was followed in F. D. Crowdy's case by complete recovery as far as the pneumothorax was concerned (*Brit. Med. Jour.*, vol. i., 1898, p. 367).

³⁷ Dr. F. R. Walters has kindly told me of a gentleman under his care who illustrated this point. See also Dehio's case described in the *St. Petersburg Medicinische Wochenschrift*, 1900, No. 25, p. 247.

³⁸ *Loc. cit.*, p. 303 (Case 7).

³⁹ *Loc. cit.*, p. 821 (Appendix). See also S. West, the Treatment of Pyopneumothorax, *THE LANCET*, Oct. 22nd, 1904, p. 1144.

⁴⁰ *Le Pneumothorax*, p. 186.

tuberculous pyopneumothorax in which surgical treatment (incision or resection of part of a rib) led to good results. Leyden⁴¹ described two cases of tuberculous pyopneumothorax in which a successful result was obtained by drainage with resection of part of a rib, aided by general treatment against the tuberculosis. One of these patients had already lived two and a half years from the onset of the pneumothorax. Case No. 22 of Emerson's collection from the Johns Hopkins Hospital illustrates an at first fairly successful result of operation on pyothorax following a pneumothorax in a tuberculous subject. The improvement did not last but the case was altogether an unfavourable one.⁴² D. W. Finlay⁴³ in 1904 recorded the case of a young man who, in 1900 at the age of 17 years, was admitted into the Aberdeen Royal Infirmary with tuberculous pneumothorax on the left side. There was some fluid effusion, serous at first, but afterwards becoming purulent. The case was treated by free incision and on different occasions resection of portions of several ribs and was likewise treated by open air on the balcony of the wards. The patient regained sufficient health to resume his occupation but there still remained a discharging sinus and a cavity of the capacity of one and a half ounces, the daily discharge of pus being about a teaspoonful; moreover, the urine had for some time contained albumin. Bäumlér⁴⁴ narrated the case of a lady, aged 26 years, in whom the empyema following a tuberculous pneumothorax was subsequently treated in Denmark by repeated extensive resections of ribs but a small thoracic fistula still remained. In this connexion I may also refer to the second of the three cases I have already narrated. The patient in question, who was operated upon for pyopneumothorax in January, 1903, is now living in fair health but there is still a thoracic fistula discharging slightly. Her urine was free from albumin when examined in April, 1905. In February, 1904, at the Clinical Society of London, E. M. Corner⁴⁵ showed a man, aged 32 years, in whom pulmonary tuberculosis was first detected in 1898. In 1901 and 1902 on account of pyopneumothorax ribs were removed on the principle of Estländer's thoracoplasty. The result was com-

⁴¹ Proceedings of the Verein für Innere Medizin, Berlin, February and March, 1890, *Deutsche Medicinische Wochenschrift*, 1890.

⁴² Vide Emerson, loc cit., p. 264.

⁴³ Transactions of the Clinical Society, 1904, vol. xxxvii., p. 183.

⁴⁴ *Deutsche Medicinische Wochenschrift*, 1894, vol. xx., p. 739.

⁴⁵ Transactions of the Clinical Society, 1904, vol. xxxvii., p. 243.

plete healing, except for an aerial fistula, through which air could be expired. In the discussion at the Clinical Society when the case was shown, W. G. Spencer stated that he had operated on a case of pyopneumothorax and had removed a lot of caseous material from the lower lobe of the lung, and that apparently the disease had not advanced for three years following the operation. In conclusion, I would remark that cases of tuberculous pyopneumothorax in which anything like an Estländer's operation can be recommended must be very rare indeed.

Whatever local treatment be adopted every endeavour must be made to improve the patient's general condition,⁴⁶ for, even if he recover from the local condition of pneumothorax, it is upon his general state of health (connected with his occupation, food, and general mode of life) that his power of resisting the advance of the tuberculosis mainly depends. In the chronic cases of hydropneumothorax and pyopneumothorax the patient should have a generous diet, plenty of fresh air, and all the advantages of the modern treatment of pulmonary tuberculosis. In this connexion certain writings of F. Penzoldt⁴⁷ and L. Spengler⁴⁸ are very instructive. Penzoldt's patient was a medical man, aged 30 years, who in April, 1900, presented physical signs of tuberculosis in the lower posterior part of the left lung; tubercle bacilli were detected in the sputum. At the commencement of June, 1900, pneumothorax of the left side developed and after two months became converted into a pyopneumothorax, the pus being apparently of the "empyème graisseux" kind. By the end of August the air in the pleural cavity was completely replaced by the fluid effusion. The treatment adopted consisted in repeated tappings and iodoform injections, together with rest in the open air and good feeding. To the strict observance of modern open-air principles Penzoldt in great part attributes the successful result. After July, 1900, there was no fever. During 1901 and 1902 the signs of empyema slowly cleared up and the heart gradually returned to its normal position. The cough and expectoration diminished and finally altogether ceased and the patient's weight steadily increased. Finally, he was able to return to work,

⁴⁶ Leyden in 1890 at the Berlin Verein für Innere Medizin drew attention to the great importance of combining general hygienic treatment with local treatment in such cases.

⁴⁷ Deutsches Archiv für Klinische Medizin, 1905, vol. lxxxiv., p. 57.

⁴⁸ Zeitschrift für Tuberkulose, Leipsic, 1901, vol. ii., pp. 27, 105.

and at the end of 1904 only slight impairment of resonance could still be detected over the left lung, at the apex and just outside the cardiac area. L. Spengler's results are quite as remarkable and speak highly in favour of the climatic and general treatment at Davos. Out of 20 cases of tuberculous pneumothorax under his care at Davos complete apparent cure resulted in five of the patients (ages between 18 and 30 years) with the exception that a small chronic pleuritic effusion remained in one of them. A serous or sero-purulent effusion was present in all five cases, but operative treatment was limited to tapping. Two of the patients were under observation several years after their recovery.

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